

ART. XII.—*An Eocene Molluscan Fauna from Victoria.*

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[Read 10th December, 1942; issued separately 1st October, 1943.]

**Abstract.**

*Lahillia-Cucullaea* fauna from ferruginous grits near Pebble Point, S.E. of Princetown, shows relationships to the Wangaloan fauna of New Zealand and more distantly to those of the Late Cretaceous and Early Tertiary of S. America and Antarctica. It is very different from known Australian faunas and is tentatively referred to the Lower Eocene or possibly Paleocene. The following are described as new species: *Nuculana paucigradata*, *Cucullaea (Cucullona) psephca*, *Lahillia australica*, *Dentalium (Fissidentalium) gracilicostatum*.

**Introduction.**

The Older Tertiary marine deposits of Victoria were regarded by Tate and Dennant and by Hall and Pritchard as referable to the Eocene, a view still held by Dr. G. B. Pritchard. On the other hand, Professor McCoy since 1866 maintained that these beds, which for the most part are contained in the Barwonian System, were post-Eocene, a view officially adopted by the Victorian Geological Survey, and supported for the past 30 years by Chapman and by most other workers in this field, including the writer, who still believes the Barwonian deposits to be post-Eocene. Although he has recently stated (1941, p. 11) that "Paleocene to Middle Eocene horizons are as yet unknown in Australia . . .", the known Upper Eocene being confined to Western Australia, it now appears that marine deposits probably low in the Eocene, perhaps even Paleocene, are present in Victoria.

In the present paper is offered a preliminary account of the marine mollusca, other than the cephalopods, which are described by Dr. Teichert (1943), of the ferruginous grits which overlie the Jurassic strata in coastal sections near Pebble Point, about 2½ miles south-east of Princetown on the Gellibrand River. The stratigraphy is fully discussed by Mr. G. Baker (1943), to whom the writer is indebted for the opportunity to examine the fossils collected by him in January, 1942, from 30-40 feet above the Jurassic-Tertiary unconformity surface at the second point north-west of Pebble Point. Unfortunately, the very resistant matrix makes collecting difficult, and most of the present material is badly weathered and in many cases is too imperfect for specific description. Thanks are also due to Mr. W. J. Parr for placing at the writer's disposal fossils collected by him in October, 1915, from the same horizon on the south-east side of Pebble Point, and to Mr. J. S. Mann for the photographs. It is hoped that further collecting in the near future will furnish better material, and it is probable that the faunal list will be considerably increased.

### Previous Literature.

The fossiliferous beds at this locality, which is Wilkinson's No. 6, are described (1865, p. 24) by him as ". . . 50 feet of thin ferruginous sandy beds, with small rounded quartz pebbles, the uppermost beds containing fossils principally, *Cuculea*, *Cytheroea*, and *Nautilus*, labelled No. 6; . . ." The *Cytheroea* are undoubtedly the shells herein referred to *Lahillia*, which with *Cucullaea* are the largest and commonest bivalves in these beds. More accessible than Wilkinson's report are copious extracts therefrom made by Duncan, which include (1870, p. 292) the passage above cited.

Tate and Dennant do not refer to this locality in their account (1893, p. 214) of the Tertiary beds near Princetown, though in a later paper they state (1896, p. 140): "The Otway Eocenes are certainly underlain by Mesozoic strata, but at the Gellibrand these suddenly disappear close to Pebble Point, and are not met with again to the west on either the Victorian or South Australian coast."

Pritchard (1925, p. 935) apparently referred the present beds to the Janjukian as ". . . coarse grits and conglomerates with an abundance of broken and imperfect fossils at other localities [than the Spring Creek section, i.e., type Janjukian], which clearly represent this horizon, notably east of the Gellibrand River flanking the Jurassic . . .", but no one except Wilkinson appears to have published any identifications.

### Systematic Description.

Class PELECYPODA.

Family NUCULANIDAE.

Genus **Nuculana** Link, 1807.

*Nuculana* Link, Besch. Samml. Rostock, iii., p. 155, 1807.

Genotype (by monotypy): *Arca rostrata* Chemnitz = *Mya pernula* Müller. Recent, Northern Europe. Figured by H. and A. Adams, Gen. Rec. Moll., iii., pl. 126, figs. 4a, 4b, 1858.

NUCULANA PAUCIGRADATA, sp. nov.

(Pl. XII., figs. 1a, b.)

Holotype.—Shell of moderate size and inflation; anterior end regularly rounded, passing evenly into the gently curved ventral margin, posterior end thin, bluntly rostrate, posterior dorsal margin long, nearly straight; umbo low, anterior; surface with distant but strongly marked growth stages, more closely spaced towards the ventral margin, otherwise apparently smooth though somewhat worn.

Hinge with chevron-shaped teeth, about nine in anterior and fifteen in posterior series, which make an angle of about  $145^\circ$ , as

well as three or four very minute teeth on each side of the small, deep, broadly triangular chondrophore; both series approximately linear, the anterior increasing in size, the posterior small but constant in size. Length 11 (slightly imperfect), height 6, thickness of valve 2 mm.; umbo,  $4\frac{1}{2}$  mm. from anterior end.

Type Locality.—Coastal cliffs  $2\frac{1}{2}$  miles south-east of Princetown, Victoria. Holotype from second point north-west of Pebble Point. Occurs also in bay south-east of this locality as well as on east side of Pebble Point.

Type Material.—Holotype (Pl. XII., fig. 1a, b) left valve, coll. and pres. G. Baker, Melb. Univ. Geol. Dept., Reg. No. 1868.

The holotype is slightly broken posteriorly, giving an appearance of truncation, but the growth lines and other specimens show the posterior end to be bluntly rostrate but not keeled. Though not uncommon, all the available specimens are more or less worn, and it is therefore with some misgiving that a specific name is given to the best of these. The length ranges from 10 to 13.5 mm., but one worn and slightly imperfect shell in the writer's possession, from the second bay north-west of Pebble Point, and apparently referable to the same species, measures  $21 \times 11 \times 3.5$  mm.

The anterior position of the umbo and lack of strong inflation of the shell seem to preclude reference to the subgenus *Jupiteria* Bellardi, which it otherwise resembles.

Of Australian Tertiary species, it distantly recalls the Kalimnan *N. praelonga* (Tate), which is at once separable by the post-median position of the umbo. The New Zealand Wangaloan *N. (Jupiteria) taioma* Finlay and Marwick (1937, p. 16, Pl. 1, figs. 1, 3, 6) shows more resemblance, but the umbo is more nearly median and the shell is apparently less produced posteriorly.

#### Family CUCULLAEIDAE.

##### Genus *Cucullaea* Lamarck, 1801.

*Cucullaea* Lamarck, Syst. Anim. s. Vert., p. 116, 1801.

Genotype (by monotypy): *Cucullaea auriculifera* Lamarck (= *Arca labiata* Solander = *concamera* Bruguière). Recent, Indo-Pacific. Figured by Tryon, Struct. and Syst. Conch., iii., pl. 127, fig. 74, 1884.

##### Subgenus *Cucullona* Finlay and Marwick, 1937.

*Cucullona* Finlay and Marwick, N.Z. Geol. Surv. Palaeont. Bull. 15, p. 19, 1937.

Genotype (by original designation): *Cucullaea (Cucullona) inarata* Finlay and Marwick. Wangaloan (Danian), New Zealand. Figured by Finlay and Marwick, *op. cit.*, pl. 2, figs. 2-5.

## CUCULLAEA (CUCULLONA) PSEPHEA, sp. nov.

(Pl. XIII. figs. 7a, b; 8a, b.)

Holotype.—A gerontic right valve. Shell moderately large, heavily built, roundly subquadrate, inequilateral, much inflated; dorsal margin weakly shouldered, anterior margin steep, passing into the gently rounded ventral margin, posterior margin oblique, weakly insinuate; posterior slope with a broad but shallow groove from the umbo to the posterior sinus; umbo anterior, prominent, strongly incurved, slightly anterior to centre of hinge-line; surface where well-preserved almost smooth, with concentric lines of growth through which are seen faint submerged radii; these are exposed in the weathered portions as strong flattened radial ribs, about seven in 10 mm. at the centre of the disc, with interspaces about half as wide as the ribs; umbonal region eroded, with about eight well marked growth stages, usually but not always with increasing interspaces which are crossed by radial riblets, about seventeen in 10 mm. at 18 mm. from the umbo; towards the ventral margin the growth-lines become undulose, directed ventrally where they cross the ribs.

Ligamental area high and long, slightly concave, with twelve or thirteen deeply incised chevrons which bear on their dorsal surfaces fine grooves subparallel to the hinge-line but tending to curl upward at the far end from the umbo; the area is 10 mm. high and deeply encroaches on the hinge teeth, of which only the anterior end of three long, striated, subparallel teeth, slightly oblique, can be seen, the posterior series being obscured by matrix; the median portion of the hinge bears irregular denticulations, about six in 4 mm. Anterior adductor scar slightly impressed, inner ventral margin of shell crenulate, rest of interior obscured by matrix. Length 60, height 50, thickness of valve 27 mm. Length anterior to hinge 3, of hinge 45, posterior to hinge 12; maximum height of hinge from ventral border 36 mm. Ratio of anterior to posterior portion of hinge 0.96.

Paratype.—An ephebic right valve. The exterior is poorly preserved and weathering has exposed the underlying radial structure. The shape in the ephebic stage is less drawn out posteriorly than in the holotype and the posterior groove is scarcely recognizable.

Ligamental area with divaricate grooving largely eroded, exposing extremely fine vertical lineations, about eight per mm.; beneath the umbo are developed coarser irregular vertical ridges which on reaching the hinge-line give place to irregular transverse taxodont teeth. Anterior and posterior teeth each four in number, the upper ones long and nearly horizontal, the lower ones much shorter and inclining downward, the sides finely transversely striate. Anterior adductor scar scalene, posterior scar subquadrate, ridged anteriorly; ventral margin internally strongly crenate, about seven in 10 mm. Length 41, height 35, thickness of valve 17 mm.

Length anterior to hinge 2, of hinge 32, posterior to hinge 7; maximum height of hinge from ventral border 27 mm. Hinge ratio 1.00.

Type Locality.—Coastal cliffs  $2\frac{1}{2}$  miles south-east of Princetown, Victoria. Holotype and paratype from second point north-west of Pebble Point. Occurs also in bay south-east of this locality, on the east side of Pebble Point, and in fallen blocks about  $\frac{1}{4}$  mile south-east of this latter.

Type Material.—Holotype (Pl. XIII., fig. 7a, b), Reg. No. 1869, and paratype (Pl. XIII., fig. 8a, b), Reg. No. 1870, right valves, coll. and pres. G. Baker, in Melb. Univ. Geol. Dept.

This species is very close to *Cucullaea* (*Cucullona*) *inarata* Finlay and Marwick (1937, p. 20, Pl. 2, figs. 2-5), from which it differs chiefly in being narrower in the umbonal region and in having a much weaker posterior sinus. It is not impossible that a longer series may bridge these differences.

To the well-known Barwonian species *Cucullaea corioensis* McCoy (see Singleton, 1932, p. 300, Pl. 26, fig. 19), it bears little relation, the present species having an evenly rounded instead of oblique ventral margin, whose internal denticulation is short and marginal instead of elongate and within the margin, longitudinal hinge-teeth directed obliquely outwards and downwards instead of upwards, and external surface smooth instead of radially ribbed. Indeed, the two species are not consubgeneric, *C. corioensis* being referable to *Cucullaea*, *s.str.*

It is probable, however, that McCoy's locality record (Prodromus Palaeont. Vic., decade iii., p. 33, 1876) of *C. corioensis* as "Rare east of Gellibrand River (very thick variety)" is based on the present species.

#### Family LIMOPSIDAE.

#### Genus *Limopsis* Sassi, 1827.

*Limopsis* Sassi, Giorn. Ligustico di Scienze, etc., i., p. 476, 1827.

Genotype (by subsequent designation, Gray, Proc. Zool. Soc. Lond., pt. 15, p. 198, 1847): *Arca aurita* Brocchi. Miocene-Pliocene, Italy. Figured by Brocchi, Conchologia Fossile Subapennina, pl. 11, fig. 9a, b, 1814.

#### LIMOPSIS, sp. nov. (?)

(Pl. XII., fig. 2a, b.)

Shell obliquely subtrigonal, moderately convex; dorsal margin short, shouldered at either end, anterior and ventral margins regularly rounded, the latter oblique and meeting with a slight angulation the steeply sloping posterior margin; umbo minute, prominent. Surface of shell poorly preserved, but marked by strong lines of growth; near the ventro-posterior angle the crossing of these by faint radii gives rise to an obscurely tessellate ornament.

Hinge-line strongly arched, with six anterior and five posterior teeth of unequal size, the posterior series slightly uncinatè, encroached upon by the prominent and high ligamental area which is longitudinally striate and divided unequally by the very large, well-developed broadly triangular ligament pit, with undulous longitudinal striae. Inner margin of shell narrowly planate, less than  $\frac{1}{2}$  mm. wide. Length 10·8, height 11·3, thickness (right valve) 3·3 mm.

The above description is based on a shell (Melb. Univ. Geol. Dept., Reg. No. 1872) from the second point north-west of Pebble Point, collected by Mr. G. Baker. Although the poor preservation of the exterior of this and of the other specimens available makes it undesirable to attach a specific name, there is little doubt that it is distinct from other Australian Tertiary species of *Limopsis*.

The nearest species in point of age, the Janjukian *Limopsis chapmani* Singleton, is much less oblique at corresponding sizes and is ovate in outline instead of almost subquadrate, the ligament pit is much smaller, and the planate inner margin is nearly three times as wide as in the present species.

#### Family CARDIIDAE.

Subfamily LAHILLIINAE Finlay and Marwick, 1937.

Genus **Lahillia** Cossmann, 1899.

*Amathusia* Philippi, Tert. und Quart. Verst. Chiles, p. 135, 1887. Not *Amathusia* Fabricius, Mag. f. Insektenk. (Illiger), vi., p. 279 (Lepidoptera), 1807, nor *Amathusia* Rafinesque, Analyse de la Nature, p. 119 (Neuroptera), Svo, Palermo, 1815.

*Theringia* Cossmann, nom. nov., Revue critique de Paléozoologie, iii. (1), p. 45, Jan., 1899, as *lapsus* for *Iheringia*, corrected, *op. cit.*, iii. (2), p. 90, Apr. 1899. Not *Iheringia* Lahille, Revista Mus. La Plata, viii., p. 437 (Echinoidea), 1898.

*Lahillia* Cossmann, nom. mut., *op. cit.*, iii. (3), p. 134, July, 1899.

Genotype (for both *Amathusia* Philippi and *Lahillia*, by subsequent designation, Finlay and Marwick, N.Z. Geol. Surv. Palaeont. Bull. 15, p. 31, 1937); *Amathusia angulata* Philippi, Tertiary, Chile. Figured by Wilckens, N. Jahrb. f. Min. Geol. u. Pal., Beilage Bd., xviii., pl. 20, fig. 4, 1904 (exterior only); Ortmann, Rept. Princeton Univ. Exped. Patagonia, iv. (2), pl. 27, figs. 4a, b, 1902 (hinge).

It might be argued that *Theringia* Cossmann, though stated by him to be a typographical error, is nevertheless a valid substitute name for *Amathusia* Philippi. Strangely enough, the same misprint *Theringia* occurs, as a nomen nudum, in Bull. Soc. Géol. France [3], xxvi (6), p. 586, March, 1899, in a note on Lahille's paper. Since *Theringia* and *Iheringia* have each been used in two senses, it seems desirable to accept Cossmann's second substitute name *Lahillia*, which is well established in literature.

LAHILLIA AUSTRALICA, sp. nov.

(Pl. XII., figs. 3-5.)

Holotype.—Left valve, shell large, thin, roundly ovate, moderately inflated, anterior slope gentle, posterior slope steep; anterior dorsal margin straight, descending and passing smoothly into the evenly rounded anterior margin, posterior dorsal and posterior margins evenly but more gently curved than anterior end, meeting the broadly convex ventral margin without angulation; umbo prominent, broad, sub-median; lunule scarcely defined. Surface with low, broad, concentric folds, about 2 mm. wide with 5 mm. interspaces on the ventral slope, and somewhat irregular growth-lines, best developed on the posterior slope, where they are sharply raised and crowded.

Interior largely obscured by matrix, but hinge characters as far as seen closely agreeing with paratype. Length 76, height 73, thickness of valve 26 mm.

Paratypes.—Exterior poorly preserved but agreeing in sculpture with holotype. Right valve slightly more elongate; left valve markedly so, being more produced posteriorly; lunule in left valve excavate, bounded by a rounded ridge.

Hinge-plate thick; cardinal and posterior lateral teeth well developed, anterior laterals absent. Right hinge with small, blunt anterior cardinal, gently sloping on its dorsal and anterior surfaces and distant from the raised lunular margin, steeply sloping posteriorly to a large, deep, broadly triangular pit, inclined slightly forward. Posterior cardinal very strong and prominent, sub-triangular, arising nearly opposite umbo but directed obliquely backward and drawn up to a blunt peg-like apex, somewhat recurved upwards; anterior surface descending steeply to the triangular socket of the left anterior cardinal, posterior slope steep, descending to surface of nymph, which is high and broad. A low narrow ridge runs down nearly vertically immediately behind the umbo and the posterior cardinal; it does not reach the latter but dies out about a quarterway across the hinge-plate. Behind this ridge is a shallow depression, but there is no definite pit for the left posterior cardinal. Posterior lateral very strong, elongate, blunt, above which is a deep, wide pit separating it from the raised posterior edge of the nymph. Hinge-plate anterior to cardinal teeth with a linear shallow depression below and parallel to the lunular margin, otherwise somewhat steeply sloping towards the ventral margin of the hinge-line, which is strongly sinuate, with downward curves opposite the posterior cardinal and posterior lateral.

Left hinge with strong, high anterior cardinal directed anteriorly at about  $15^{\circ}$  from the vertical, separated from the arched and raised lunular margin; the upper surface of the tooth recurved and somewhat rounded, its lower surface triangularly bevelled and

buttressed anteriorly by a ridge which forms the lower margin of the broad triangular pit for reception of the right anterior cardinal. Left posterior cardinal narrow, low, directed posteriorly at about  $25^\circ$  from the vertical, decreasing in width and height until it dies out at the ventral margin of the hinge-plate. Surface of nymph slightly excavate, its upper edge bounded by a deep ligamental groove. Posterior lateral strong, but less heavy and elongate than that of right valve, and separated from the post-dorsal margin by a narrow elongate pit. Ventral margin of hinge-line only weakly sinuate below cardinal and posterior lateral teeth.

Adductor scars strong, deeply sunk, especially on inner sides, posterior the larger, situate high up near dorsal margin of shell. Pallial line obscure. Inner margin of shell smooth. Length 77, height 71, thickness of right valve 26 mm.; 78, 71, 26 mm. (left valve).

Type Locality.—Coastal cliffs  $2\frac{1}{2}$  miles south-east of Princetown, Victoria. Holotype from second point north-west of Pebble Point; paratypes from east side of Pebble Point. It is also found between these localities.

Type Material.—Holotype (Pl. XII., fig. 5) left valve, coll. and pres. G. Baker, Melb. Univ. Geol. Dept., Reg. No. 1865; paratypes (Pl. XII., figs. 3, 4) right and left valves, coll. and pres. W. J. Parr, Reg. Nos. 1866-7.

The present species is less closely related in dentition to the genotype of *Lahillia*, as figured by Ortmann (1902, Pl. 26, figs. 9a, b), than to *Lahillia neozelanica* Marshall and Murdoch, the type of the subgenus *Lahilleona* Finlay and Marwick (1937, p. 31). From the hinge of the New Zealand shell as figured by these authors (1937, Pl. 4, figs. 8, 9) that of the Australian species differs in the more robust right anterior lateral, the slightly backward instead of forward sloping right posterior lateral, and the better developed left posterior cardinal. In other characters, the correspondence is close. *L. australica* has, however, a higher anterior dorsal margin and thus an oval outline instead of the subtriangular shape of topotypes of *L. neozelanica* from Wangaloa, and may therein more closely resemble the high-shouldered Boulder Hill form of *L. neozelanica* reported by Finlay and Marwick.

Unfortunately, in none of the Australian shells is the pallial line clearly seen, but in one broken example it appears to descend steeply and obliquely forward from near the inner angle of the posterior scar without a sinus such as characterizes *Lahilleona*. For this reason and because of the backward slope of the posterior cardinal, a difference already noted by Wilckens (1924, p. 540) for the S. Patagonian *L. luisa* (Wilckens) of Upper Senonian age, the present species is not referred to *Lahilleona* although it otherwise appears so close to *L. neozelanica*.



*Lahillia luisa*, as figured by Wilckens (1910, Pl. 3, figs. 4-7, 11) from Graham Land, Antarctica, is a more elongate shell, more produced anteriorly and truncate posteriorly. In the left hinge the cardinals are more divergent and the ventral margin of the hinge is strongly instead of weakly sinuate; in the right valve this margin shows a very strong angulation posterior to the cardinals, while the posterior lateral tooth is at a greater angle to the horizontal than in *L. australica*.

Of the Tertiary *Lahillia larseni* (Sharman and Newton) (1900, pp. 59, 60, and Pl., as *Cyprina Larseni*; Wilckens, 1911, pp. 13, 14, Pl. 1, fig. 12) from Seymour Island, off Graham Land, the hinge-teeth and pallial line are unknown; it is, however, a more elongate shell than *L. australica*.

Class SCAPHOPODA.

Family DENTALIIDAE.

Genus **Dentalium** Linné, 1758.

*Dentalium* Linné, Syst. Nat., ed. 10, p. 785, 1758.

Genotype (by subsequent designation, Montfort, Conch. Syst., ii., p. 23, 1810): *Dentalium elephantinum* Linné. Recent, East Indies (Amboyna) and Philippine Islands. Figured by Pilsbry and Sharp, Tryon's Man. Conch., [1] xvii, pl. 1, figs. 1-7, 1897.

Subgenus **Fissidentalium** Fischer, 1885.

*Fissidentalium* Fischer, Man. Conchyl., p. 894, 1885.

Subgenotype (by monotypy, as section): *Dentalium ergasticum* Fischer. Recent, Gulf of Gascony and Atlantic Ocean. Figured by Pilsbry and Sharp, *loc. cit.*, pl. 15, figs. 35-36, 1897.

DENTALIUM (FISSIDENTALIUM) GRACILICOSTATUM, sp. nov.

(Pl. XII., figs. 6a, b; Pl. XIII., figs. 9a, b.)

Holotype.—Shell moderately large, solid, tapering fairly rapidly, moderately curved, dorso-ventrally compressed, slightly elliptical in cross-section, wall thick, apex wanting.

Surface with fine longitudinal ribs, about 57 in number; at the narrower end the ribs are unequal in size, rather high, narrow, rounded above, and parted by furrows which are wider than the ribs; anteriorly the ribs become broader and flattened, so that the interspaces are relatively much narrower and almost linear. The longitudinal sculpture is crossed by faint lines of growth, more marked towards the larger end, where they indicate that the aperture was decidedly oblique, and by somewhat irregular growth stages, about eight in number. Length (imperfect) 22; transverse diameter of apertural end, 5.5; dorso-ventral diameter, 5; thickness of shell, 0.8; diameter of posterior end, 3.7 (transverse), 3.2 mm. (dorso-ventral). Change in direction of axis in 2 cm., about 8°.

Type locality.—Coastal cliffs  $2\frac{1}{2}$  miles south-east of Princetown, Victoria. Holotype from bay between first and second points north-west of Pebble Point. Occurs also at Pebble Point and at the second point north-west of it.

Type Material.—Holotype (Pl. XII., fig. 6a, b; Pl. XIII., fig. 9a, b), coll. and pres. G. Baker, Melb. Univ. Geol. Dept., Reg. No. 1871.

Although the apical characters are unknown, the specimens available being very imperfect, the size and solidity of the shell and its numerous ribs justify its reference to *Fissidentalium*. The fineness of the ribbing and the thickness of the shell wall readily distinguish it from other Australian Tertiary species.

### Age of the Fauna.

The paucity and imperfect preservation of the shelly fauna of the Pebble Point beds make correlation difficult, but it is at once evident that the occurrence of *Lahillia* sharply differentiates it from the known Australian faunas and links it rather with those of South America, Antarctica, and New Zealand.

In Chile, *Lahillia* ranges from the Upper Cretaceous (Senonian) Quiquirina beds to the Miocene Navidad beds, while in South Patagonia and in Graham Land the range is approximately the same. In no case is the relation to *Lahillia australica* particularly close. In New Zealand, Finlay and Marwick (1937, pp. 10, 13, 31-3) discuss the late Cretaceous records of *Lahillia* and refer its highest occurrence, as *Lahillia (Lahilleona) neozelanica*, in the Wangaloan, to the Danian. *Lahillia australica*, as noted under that species, appears closer to *L. neozelanica* than to the South American and Antarctic forms, were it not that the New Zealand shell is sinupalliate. Such a character implies so marked a distinction that it is unfortunate the Australian material does not permit a decision as between *Lahilleona* and *Lahillia*, *s. str.* The backward slope ventrally of the posterior cardinal tooth is a character shared with the Upper Senonian *Lahillia luisa* and on the whole *Lahillia australica* appears related more closely to the late Cretaceous than to the Tertiary species.

While *Cucullaea*, *sensu lato*, ranges from the Mesozoic to the present, the subgenus *Cucullona* has hitherto been reported only from the Wangaloan. Indeed, the Australian *C. psepheia* is so close to the Wangaloan *C. inarata* as to suggest approximate identity of age.

Of the remainder, *Nuculana paucigradata* and the *Limopsis* afford little definite evidence as to age. The former only distantly resembles the Wangaloan *N. taioma*, while the latter is very different from the Wangaloan species.

*Dentalium (Fissidentalium) gracilicostatum* is also quite unrelated to the Wangaloan scaphopods: *Fissidentalium* did not appear, so far as the writer knows, before the Eocene.

The conclusions to be drawn from this survey are not very definite. The complete specific, and in part generic or subgeneric distinction from the Australian Janjukian faunas, even when the latter are of comparable shallow water facies, as at Table Cape, Tasmania, suggests a considerable time difference, so that it is unlikely that the Pebble Point fauna is younger than Eocene. The earliest occurrence of the *Lahillia-Cucullaea* association is in the Senonian of South America and Antarctica, where it is associated with ammonoids; in New Zealand, it is found without ammonoids on a higher horizon, the Wangaloan, correlated by Finlay and Marwick with the Danian, but not in the Bortonian (? Middle Eocene); and it persists into the Tertiary of South America and Antarctica.

The Pebble Point fauna, therefore, probably falls within the range from Danian to Lower Eocene, a conclusion supported by the occurrence (Teichert, 1943) in it of the Nautiloid genus *Aturoidea*, which elsewhere has this range. A correlation with the Wangaloan is suggested by the occurrence in both of *Cucullona*, but the writer is not fully convinced that the Wangaloan is Danian rather than Paleocene, and, moreover, the Wangaloan fauna contains a Cretaceous element as yet unknown in the fauna here described. The occurrence in the Pebble Point beds of *Fissidentalium* points also to an Eocene age, so that they may tentatively be referred to the Lower Eocene, with a possibility that they may be as old as Paleocene.

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### Explanation of Plates.

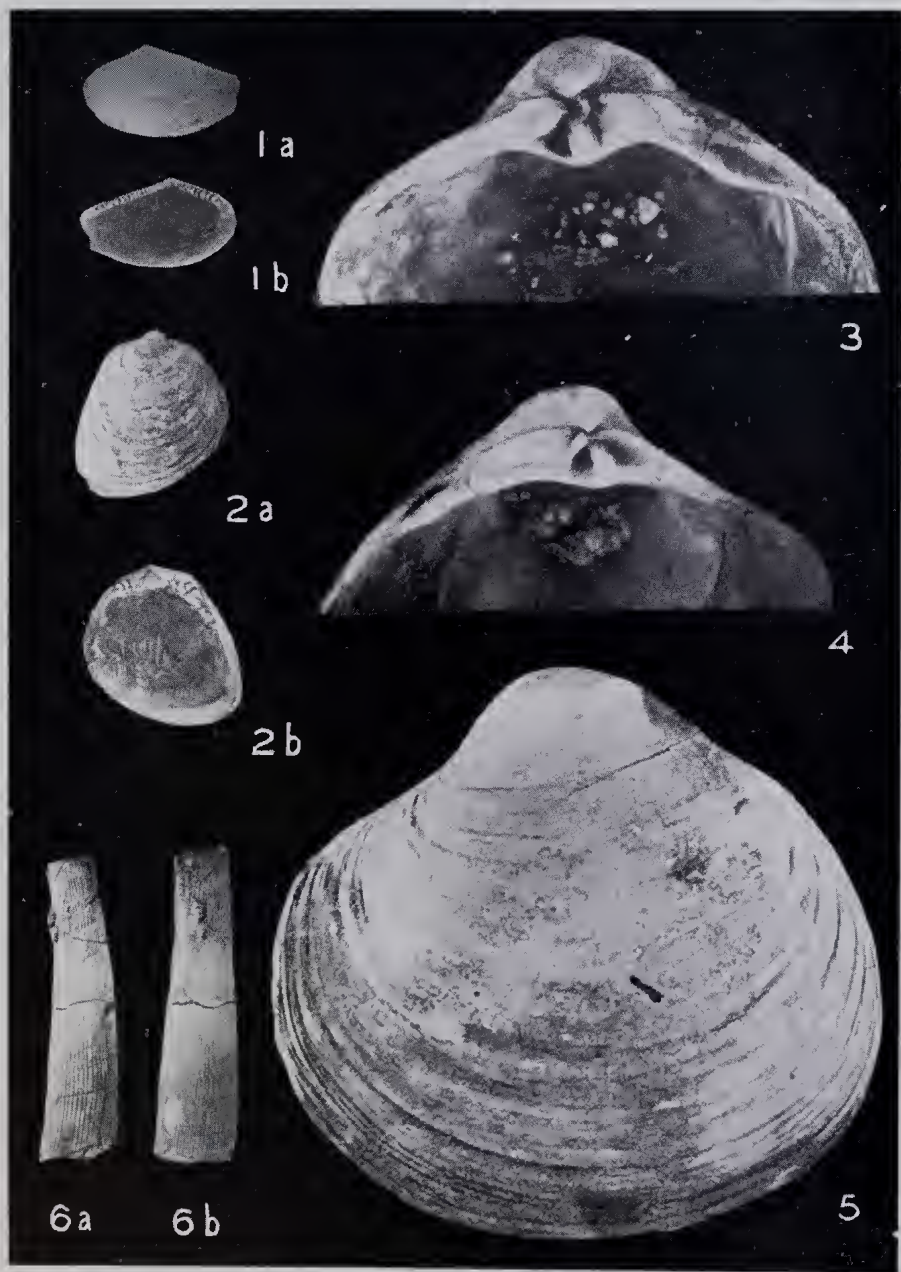
#### PLATE XII.

- FIG. 1A, B.—*Nuculana paucigradata*, sp. nov. Holotype.  $\times 2$ .
- FIG. 2A, B.—*Limopsis*, sp.  $\times 2$ .
- FIG. 3.—*Lahillia australica*, sp. nov. Paratype, right hinge, nat. size.
- FIG. 4.—*Lahillia australica*, sp. nov. Paratype, left hinge, nat. size.
- FIG. 5.—*Lahillia australica*, sp. nov. Holotype, nat. size.
- FIG. 6A, B.—*Dentalium (Fissidentalium) gracilicostatum*, sp. nov. Holotype, a, lateral aspect; b, dorsal aspect,  $\times 2$ .

#### PLATE XIII.

- FIG. 7A, B.—*Cucullaea (Cucullona) psepheia*, sp. nov. Holotype, nat. size.
- FIG. 8A, B.—*Cucullaea (Cucullona) psepheia*, sp. nov. Paratype, nat. size.
- FIG. 9A, B.—*Dentalium (Fissidentalium) gracilicostatum*, sp. nov. Holotype, a posterior portion of Fig. 6B.  $\times 6$ ; b, ornament.  $\times 12$ .

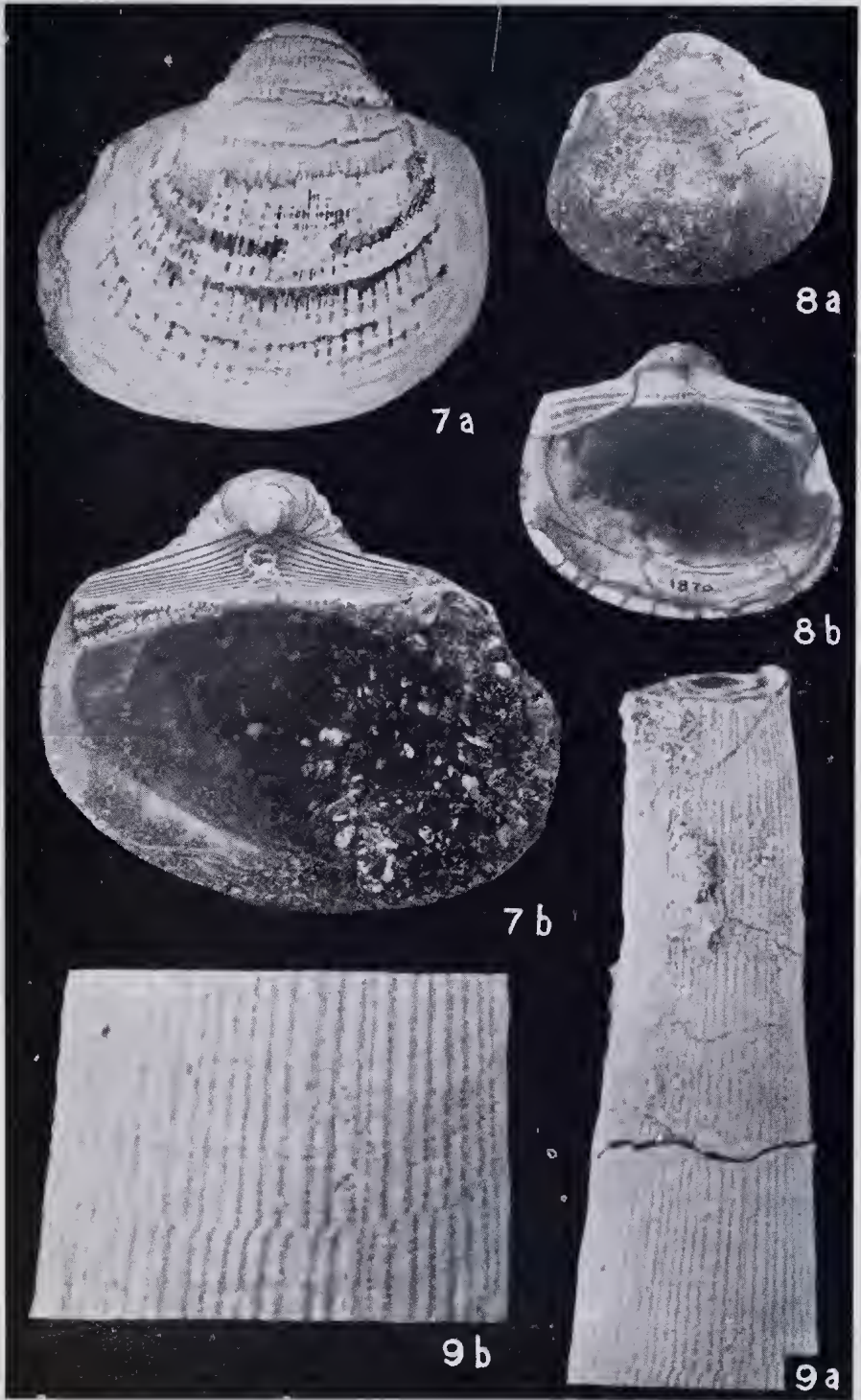
NOTE:—Owing to discolouration by ferruginous stains, the shells were coated with ammonium chloride before being photographed.



J. S. M. photo.]

Victorian Eocene Mollusca.





J. S. M. photo.]

Victorian Eocene Mollusca.